



LIEBERT FS FLYWHEEL ENERGY STORAGE SYSTEM - 190 kW, 10 SECONDS

General Specifications

INPUT	
Voltage	520VDC, Nominal (Recharge)
Voltage Range	480 to 540VDC
ENVIRONMENTAL	
Operating Temperature	-4°F to 122°F (-20°C to 50°C)
Non-Operating Temperature	-4°F to 176°F (-20°C to 80°C)
Relative Humidity	5-95% non-condensing
Operating Altitude	Up to 9,842 ft. (3,000m)
Acoustical Noise	45 dBA in Ready Mode, measured 3.3 ft. (1m) from the unit

OUTPUT	
Voltage	510VDC, Nominal (Discharge)
Voltage Range	480 to 540VDC
STANDARDS	
<ul style="list-style-type: none"> • UL listed to the following Standards: <ul style="list-style-type: none"> • UL 1248, Standard for Engine/Generator Assemblies • UL 508, Standard for Industrial Control Equipment • UL 1004, Standard for Electric Motors • CSA C22.2 No. 14-95, Industrial Control Equipment • Meets current global requirements for safe, high-performance operation. 	

The Liebert FS is a technologically advanced DC energy storage system that utilizes a rotating mass as a means for storage. Over 10 years and millions of dollars of development have resulted in a safe, efficient product that can be used in place of or in parallel with batteries. Stored energy is available immediately and released upon demand—up to 190kW is available for up to 10 seconds and can be used to:

- Ride through short power outages without the need to go to battery or generator
- Provide enough time to place generators on line during prolonged blackouts without the need for batteries
- Parallel with battery strings to provide extended backup time, battery life and reliability

The Liebert FS consists of several modules. The **Flywheel Module** contains technologically advanced components. Supported by an active magnetic levitation system (**Magnetic Levitation Module**), the carbon composite flywheel rotates within two containment vessels that make up a low-loss and extremely safe operating environment. The **Power Conversion Module** is a bi-directional high-frequency converter that provides a regulated output to the DC bus during discharge and becomes a source for a variable frequency/voltage to drive (spin) the flywheel during recharge. The **Power Conversion Module Controller** monitors and keeps all components within safe operating limits. FS units may be paralleled for additional power or time.

A circuit breaker for disconnecting means (manually or automatic) is standard in the Liebert FS. Also standard is an LCD user interface that displays the system's operating status. Soft keys on the user interface provide control of the unit. Additional monitoring and control options are available.

With its quiet operation, relatively small dimensions and weight of 1300 lb. (590 kg), the Liebert FS may be installed in any typical electrical equipment environment. Installation is simple—power and control wiring are the same as those found in Liebert Battery Cabinet installations.

- Carbon Fiber Flywheel
- 5-Axis Active Magnetic Levitation System
- Integrated, Low-Loss Vacuum System
- Synchronous Reluctance Motor-Generator
- Integrated Safety System
- 5-Year Parts Warranty



Site Planning Data, Liebert FS Flywheel Energy Storage System: 190 kW, 10 Seconds

Nominal Energy Storage	Recharge		Discharge			Rotational Speed		Mechanical Data		
	Max. Current ADC	Nom. Voltage VDC	Nom. Power kW	Duration seconds	Nom. Voltage VDC	Min. rpm	Max. rpm	Dimensions W x D x H, in. (mm)	Weight lb. (kg)	Losses (W)
1900 kW-seconds	50	520	190	10	510	25,000	55,500	25 x 32.5 x 71 (635 x 826 x 1803)	1300 (590)	≤ 300
See Notes for Table (below):	1, 11	2, 11	4	4	3, 11	—	—	—	—	—

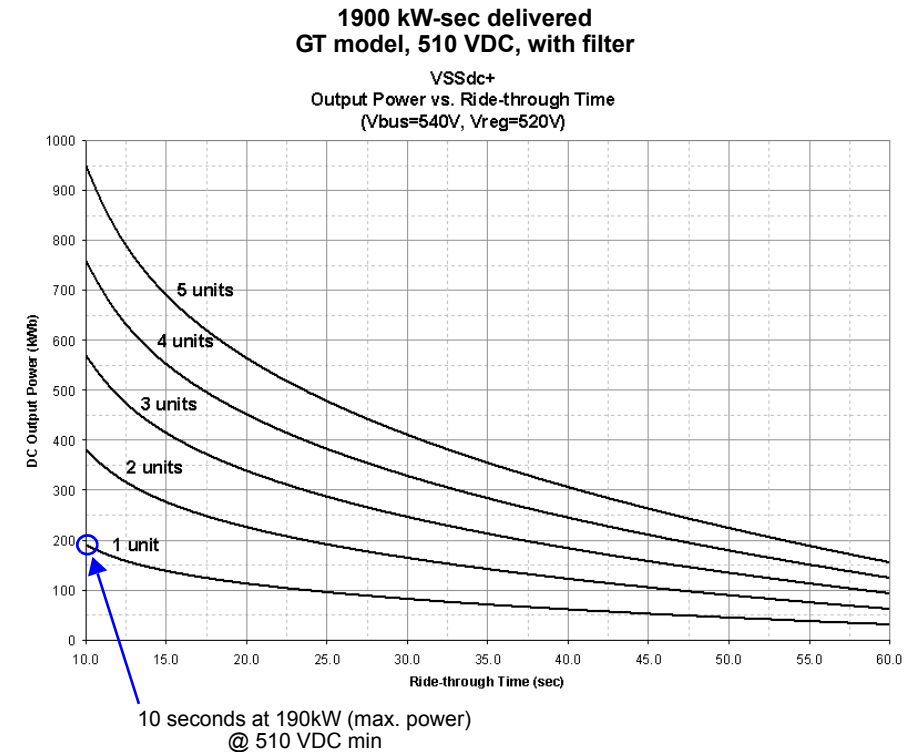
Notes for Table

- Recharge current shown is the maximum the Liebert FS can accept. This value is dependent on the UPS, typically limited to 15% of the UPS's nominal full load DC current.
- Recharge voltage is adjustable, 480 to 500VDC. 190kW requires >520VDC.
- Discharge voltage is adjustable, 480 to 500VDC. 190kW requires >510VDC.
- Discharge rates below 190kW increase the discharge duration time (see **Figure 1**). In addition, the FS has the capability to discharge at rates above 190kW for shorter discharge durations. Please consult factory for details.
- Power cable from UPS DC bus to Liebert FS should be sized for total maximum 2.0 volt line drop (power cable plus return cable drop as measured at the module) at maximum discharge current.
- Grounding conductors to be sized per NEC 250-95.
- All wiring to be in accordance with National and Local Electrical Codes.
- Minimum clearance is 3 ft. (0.9m) in front and 1 ft. (0.3m) above the Liebert FS.
- Exterior cable entry available through removable top access plates: remove, punch to suit conduit size and replace.
- Control wiring and power wiring must be run in separate conduit.
- When used with the Liebert Series 300, nominal recharge voltage is 395VDC, nominal discharge voltage is 385VDC, with adjustable range of 360 to 405VDC for both. Due to lower VDC, power output below 30 seconds must be derated. Contact factory for details.
- AC auxiliary power input required: 110/230VAC, 1 ph, 400VA.

Additional Notes

- If site configuration includes a backup emergency generator, it is recommended that the engine generator is set to be properly sized and equipped for a UPS application. Generator options would typically include an isosynchronous governor (generator frequency regulation) and a UPS-compatible regulator (generator voltage regulation). Consult the generator manufacturer for required generator options and sizing.

Figure 1 DC bus power duration



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SL-29305_REV04_04-07



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